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Hertz Vibrator

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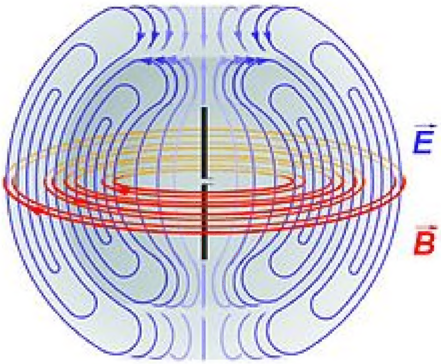
The Hertz vibrator (**Hertz** dipole, Hertz antenna) is the simplest system for receiving electromagnetic oscillations , an electric dipole whose dipole moment rapidly changes in time. It is a developed oscillatory circuit with a minimum capacitance and inductance. The first experiments with such an antenna were carried out by Hertz in 1886-1888.



The maximum flux of electromagnetic energy is radiated perpendicular to the axis of the Hertz dipole.

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History

Hertz used copper rods with metal balls at the ends, into the spark gap of which the Rumkorf coil was included [1] [2] . If a high voltage is applied to such a structure, a spark will slip in the gap, and vibrations will occur in the vibrator with a period shorter than the spark burning time. The length of electromagnetic waves is approximately two times the size of the vibrator itself [3] . The smallest of the vibrators used by Hertz (0.26 m) made it possible to obtain oscillations with a frequency of the order of 5×10^{8} Hz, which corresponds to a wavelength of 0.6 m. Hertz also placed the vibrators in the focus of concave mirrors to obtain directional plane waves .

With the help of metal mirrors and an asphalt prism, Hertz was convinced that the laws of reflection and refraction of electromagnetic waves of the invisible spectrum obey the laws of geometric optics of the visible spectrum.

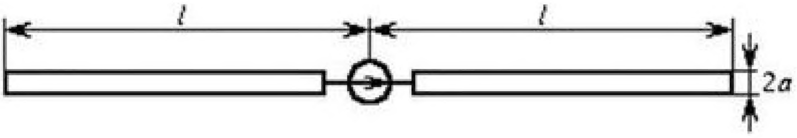
Hertz also measured the speed of an electromagnetic wave, creating a standing wave and measuring itλ.

Symmetric vibrator

Symmetric vibrator , **dipole** - the simplest and most common antenna . In the simplest version, it is a rectilinear conductor with a length of $2\ l$ *of* radius a , fed in the middle of the generator by high-frequency currents .

Half-wave vibrator

A half-wave vibrator is a model of a real vibratory antenna, which is a rectilinear ideal thin conductor (current thread), the length of which ($2\ l$) is equal to half the length of the electromagnetic wave in the environment surrounding the half-wave vibrator. A half-wave vibrator is also a vibrator antenna that is widely used in practice and a radiating element of multi-element antennas in the form of an open conductor at the ends, the total electric length of which 2 l is close to λ / 2, that is, used at a frequency close to the frequency of its first resonance.

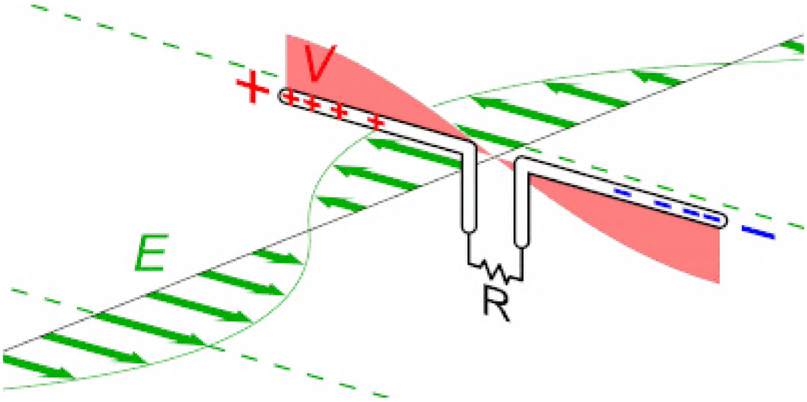


Symmetrical vibrator. l - shoulder length; 2 a - diameter of the conductor

Thin vibrator

For a wave length λif the radius of the vibrator conductors $a << l$ and $a << \lambda$, then such a vibrator is called *thin* .

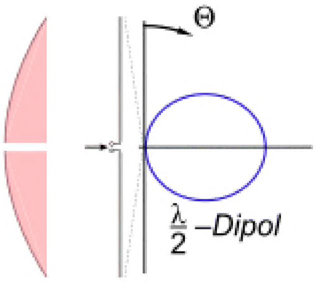
Short called a vibrator in which $l < 0.5 * \lambda$; *long* is a vibrator whose $l > 0.5 * \lambda$.

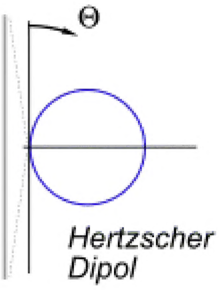


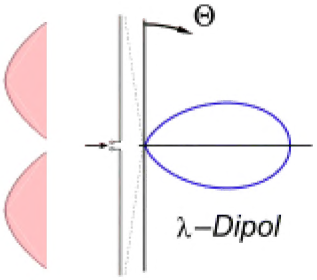
Animated radio wave receiving scheme by half-wave dipole

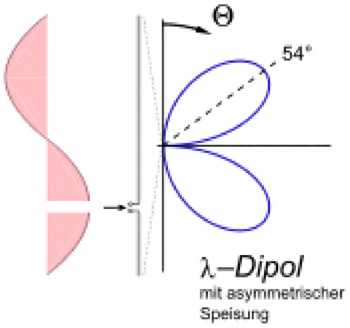
Vibrator radiation patterns

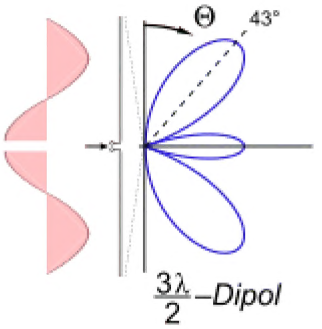
Depending on the ratio of the length of the vibrator to the wavelength, its radiation pattern takes the form shown in the figure:

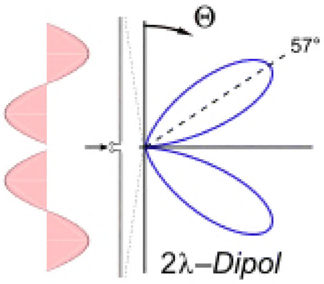












Notes

1. Virtual Computer Museum. (http://www.computer-museum.ru/connect/gerc_120.htm). www.computer-museum.ru. Date of treatment May 8, 2017.
2. Virtual Computer Museum. (http://www.computer-museum.ru/connect/histra09.htm). www.computer-museum.ru. Date of treatment May 8, 2017.
3. *Savelyev I.V.* [§106. Experimental study. Xv. Electromagnetic waves.] // General physics course. - 3. - M .: Nauka, 1988. - T. 2. - S. 307. - 337 p. - 220,000 copies.

See also

- Antenna
- Strict solution to the problem of the distribution of current on the vibrator
- Antenna Radiation Resistance

Links

- Hertz's vibrator // Great Soviet Encyclopedia : [in 30 vol.] / Ch. ed. A.M. Prokhorov . - 3rd ed. - M .: Soviet Encyclopedia, 1969-1978.

Source - https://ru.wikipedia.org/w/index.php?title=Herz Vibrator&oldid = 93761869

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